Morgan Lewis

TECHNOLOGY MARATHON

IP Protection for Inventions That Use Artificial Intelligence

David V. Sanker, Ph.D. and Matthew M. Walker

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Presenters

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Agenda

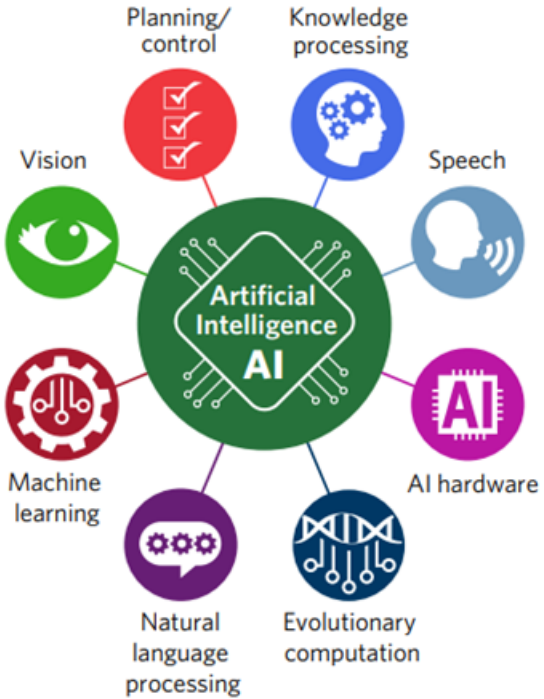
- Introduction to Artificial Intelligence and Machine Learning
- Machine Learning Building Blocks and Processes
- Intellectual Property (IP) Protection Options
- Recent Case Law Affecting Patents that use AI
- Patenting Strategies
- AI Inventors?

Artificial Intelligence and Machine Learning

- Artificial Intelligence (AI) is a very broad field, encompassing any technology that mimics human intelligence. AI includes Machine Learning (ML).
- Machine Learning refers to techniques for learning patterns and applying those learned patterns.
- Many inventions today utilize machine learning building blocks.

Example Fields of Study for AI

- **Computer Vision**: Understanding and responding to visual media.
- **Natural Language Processing (NLP):** Understanding and responding to human languages.
- **Content Services**: Personalizing content experiences for individual users and groups.



Understanding Machine Learning Building Blocks

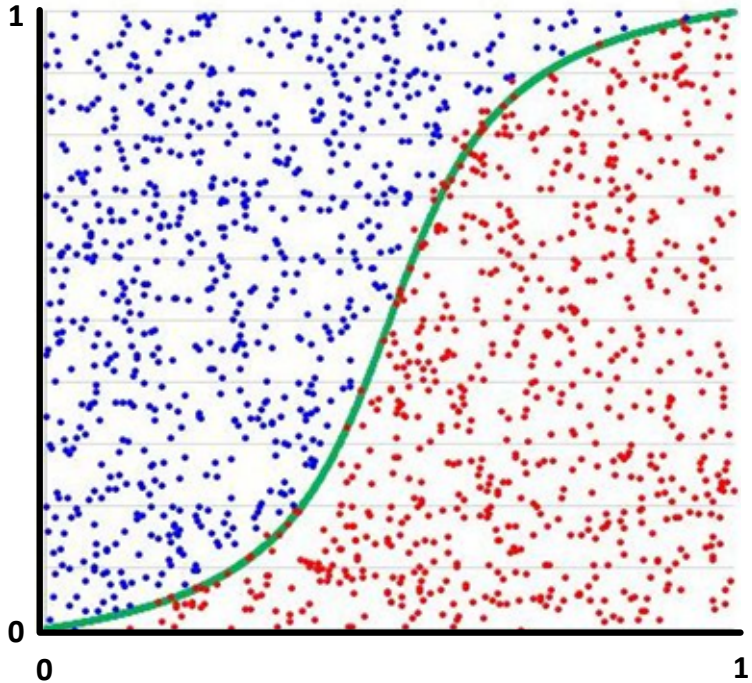
- Blackbox Approach

- The "Blackbox" can use a variety of machine learning algorithms
  - Currently a push for more explainable AI

Machine Learning Algorithms

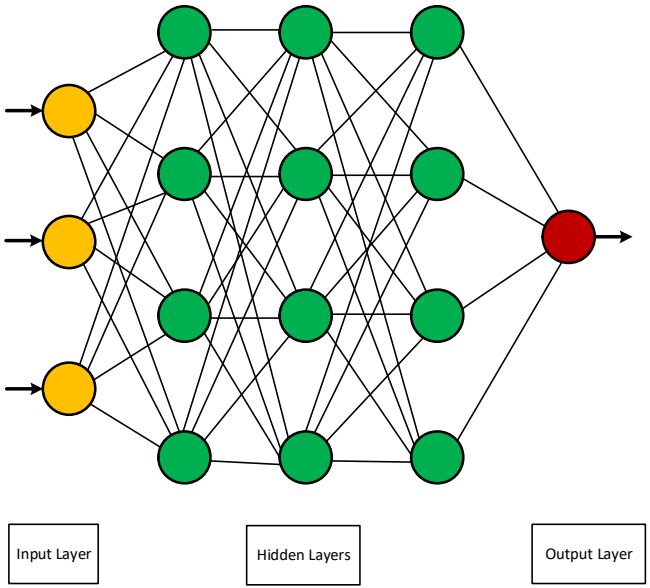
Machine Learning typically applies to Classification or Regression

- Support-Vector Machines
  - Regression and Classification problems
- Decision Trees
  - Classification problems
- Linear Regression
  - Regression problems
- Logistic Regression
  - Classification problems



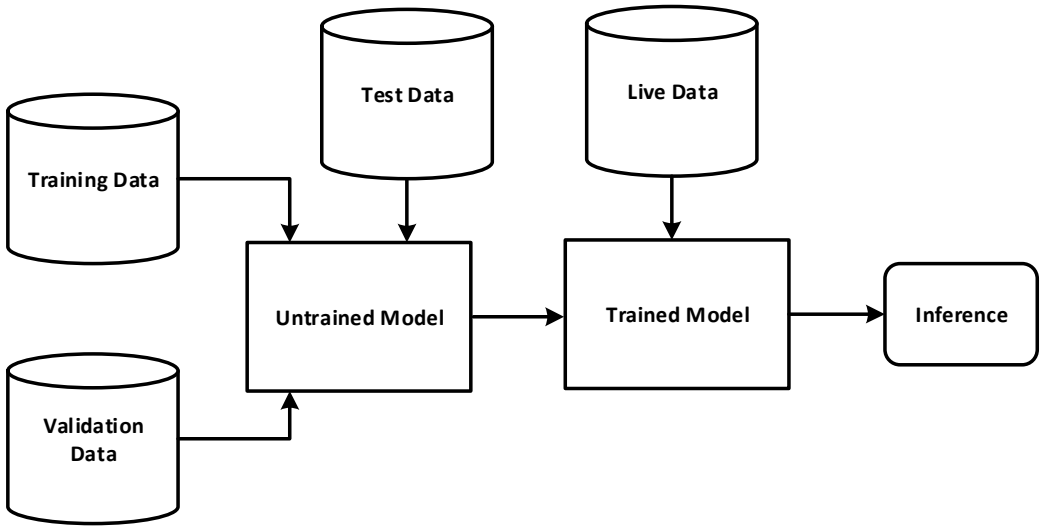
Neural Network Examples

- Simple Neural Networks
- Convolutional Neural Networks (CNNs)
  - Generally used for analyzing visual media
  - Feed-forward neural network with convolutional layers
- Recurrent Neural Networks (RNNs)
  - Generally used for NLP and text
  - Hidden cells receive their own outputs at fixed delays
- Generative Adversarial Networks (GANs)
  - Generally used for Image Generation
  - Generators create data
  - Discriminators try to distinguish generated data from real data



Machine Learning Process

- Select a Model (E.g., a type of Neural Network)
  - Based on the type of problem
  - Based on available training data
- Train the Model
- Use the Model (Inference)
  - Typically implemented in a system



Training Methodology Examples

- **Supervised Learning**: A user provides example inputs and corresponding desired outputs. For example, input images labeled as a "cat" or a "dog" for a system being trained to identify cats and dogs in images.

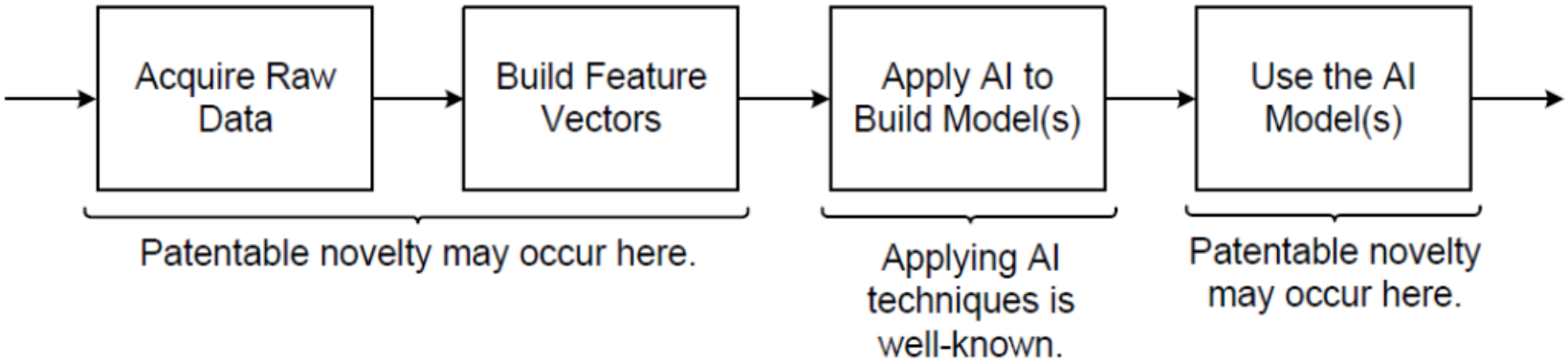
- **Unsupervised Learning**: A user provides untagged inputs, and the system learns patterns or groupings. For example, if the input consists of hand-written characters, the system can group together sets of inputs that are similar. A system can do this grouping without assigning any "meaning" to each group.

- **Reinforcement Learning**: The system is rewarded or penalized for actions taken. For example, a system for autonomous driving is penalized for crossing a lane line or going the wrong way.

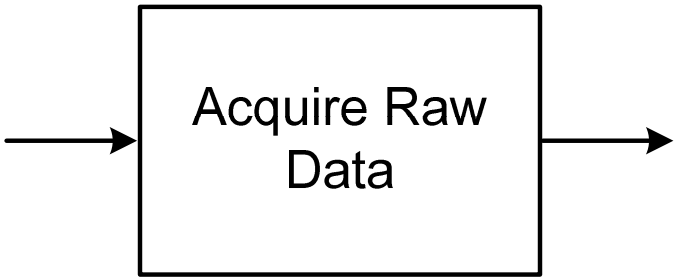
Intellectual Property Protection Options

For inventions that use AI, an overall protection strategy needs to consider both patents and trade secrets. The right choice can depend on a lot of factors.

Inventions That Use AI – Simplified Framework

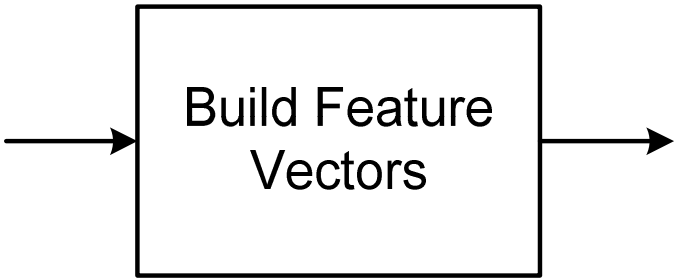


Inventions That Use AI – Simplified Framework



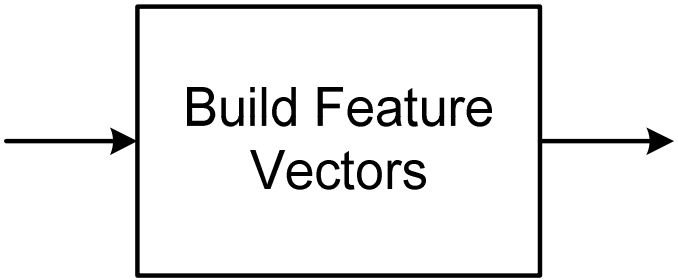
- Are any of the data elements new? New depends on context.
- Are any of new data elements non-obvious?

Inventions That Use AI – Simplified Framework



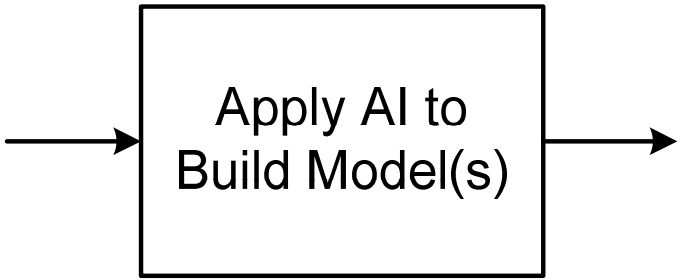
- Have the raw data elements been combined in new ways?
- Simple Boolean combinations of data elements can be handled by the AI engine, but there are many types of calculation that are beyond what current AI engines can do.

Inventions That Use AI – Simplified Framework



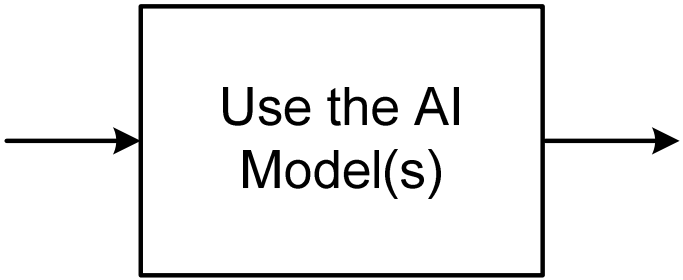
- Suppose the raw data values are r_1, r_2, r_3, …
- The simplest approach is to use these as the features: $f_1 = r_1$, $f_2 = r_2$, etc.
- But you can create more complex features, such as $(r_1 + r_2) / r_3$

Inventions That Use AI – Simplified Framework



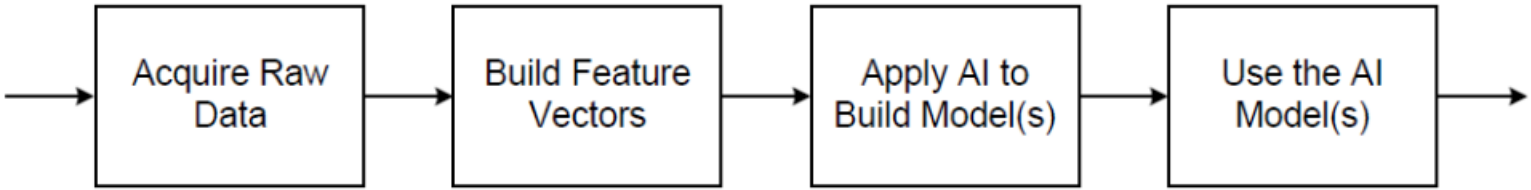
- Unless you have invented a new AI Algorithm (or a meaningful variation), this step does not affect patentability.

Inventions That Use AI – Simplified Framework



- After applying AI, do you use the output in a new way?
- For example, the AI output may be just one piece of data that is used as part of the determination of what action to take next.
- In some cases, the output of the AI is part of a novel User Interface.

Hypothetical Example (Network Security)



Collect data at many nodes in the network, including source and destination of packets, as well as packet size, volume, and type

Probably not novel

Combine data from two or more nodes (e.g., data from nodes that have no direct link)

The unique combinations can create novelty

Apply standard AI

Not novel

Notify if intrusion suspected

Not novel

Background in Trade Secrets

What is protectable as a trade Secret?

- Trade secret protection applies broadly to business, financial, and technical information, including software source code, when

  (i) the information is not generally known or ascertainable,

  (ii) the information provides independent economic value or business advantage, and

  (iii) reasonable efforts are taken to preserve secrecy.

Background in Trade Secrets

What is protectable as a trade Secret?

- Trade secret protection is theoretically unlimited in time, and does not require any government approval. Protection can continue as long as the information is kept secret.

- Even when a company takes strict measures to keep information secret, trade secret protection can be lost due to reverse engineering or independent derivation by others.

General Rules for Selecting Patents or Trade Secrets

1. Is there an invention?

   - There are many things worth protecting that would not be classified as “inventions”, such as data.

   - The determination of what is “patent-eligible” can depend on the assigned Examiner.

General Rules for Selecting Patents or Trade Secrets

2. Will the invention be publicly visible?

- If people can see the invention, then patent protection is the only option (e.g., a software user interface).
- Reverse engineering is completely legal, so even if the invention is encapsulated in a device (such as a chip used in a smart phone), good engineers and good testing equipment can generally uncover the invention.

General Rules for Selecting Patents or Trade Secrets

3. How easy is it to detect infringement?

- This question generally addresses the same issue as visibility, but expressed in a different way.
- If it is too difficult (or impossible) to identify infringement (even with reverse engineering of potentially infringing products), then a patent would not have much value.
- Infringement evidence can be acquired during litigation discovery, but it could be very costly to pursue litigation only to find there is no infringement.

Use Trade Secret Protection When …

The non-AI concepts are an "Abstract Idea"

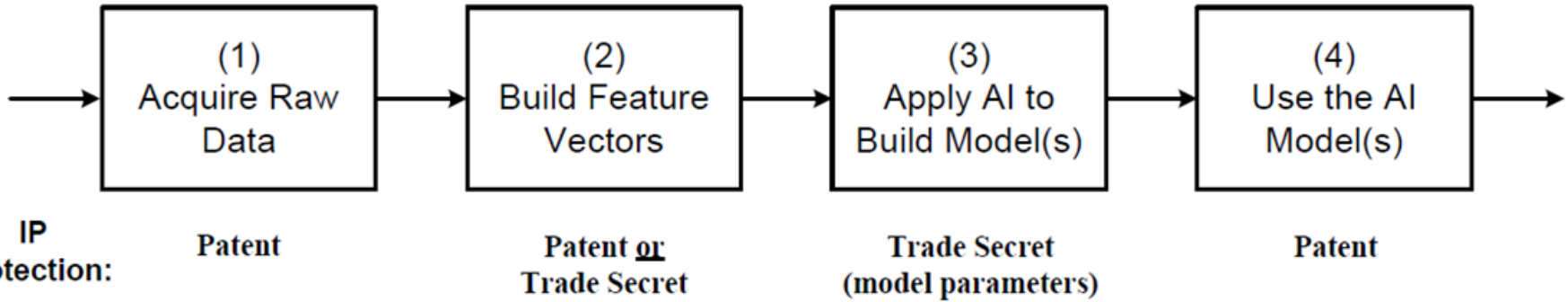
- After the Supreme Court decision in *Alice v. CLS Bank* (2014), Examiners routinely reject patent claims under 35 U.S.C. § 101, asserting that the claims are not even eligible for patent protection.
- Some Examiners reject claims as "Abstract Ideas" even when the claims recite novel, non-obvious, technical inventions. In many cases, rejections under 101 are effectively an "evidence-free 103".

Use Trade Secret Protection When …

The non-AI concepts are an "Abstract Idea"

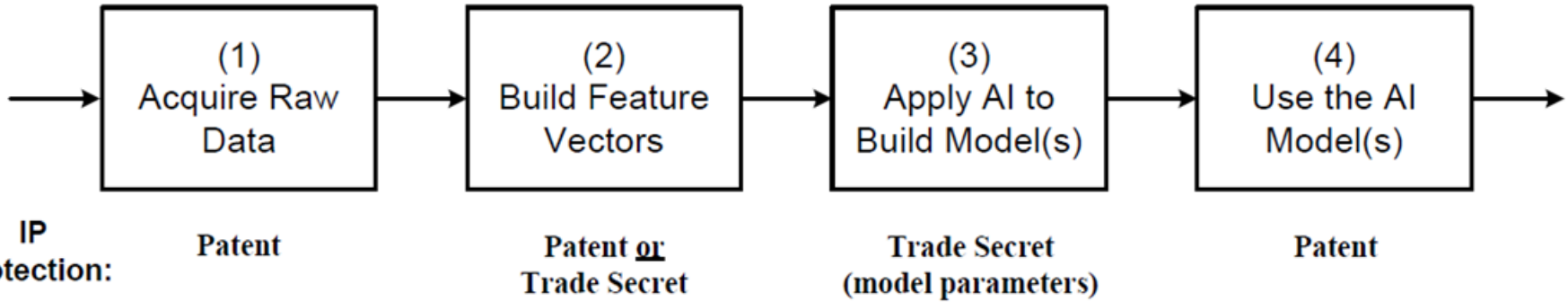
- If you really want patent protection, look for technical details and features that are not routine, and describe the invention as a technical solution to a technical problem.
- Due to the uncertainty of overcoming 101 rejections, trade secret protection is an increasingly attractive option when it is available and you have procedures in place to maintain secrecy.

Protection Based on Where the Novelty Occurs



- If the novelty is the specific raw data elements, it is difficult to keep as a trade secret.
- If the novelty is the construction of calculated features, it is more likely that the calculation can be kept secret.
- If the novelty is in the use of the AI models (e.g., a user interface), it is typically visible, so trade secret protection is generally not possible.

Protection Based on Where the Novelty Occurs



- Example: A company uses AI to develop a new way to implement cybersecurity. The new technique uses known raw data elements, but performs some novel calculations to build features that have not been previously used. The results of the AI analysis are presented in a user interface on the device where the application is running.

Patent, Trade Secret, or Neither?

Patent and Trade Secret Protection

	Patent	Trade Secret
Requirements	Invention must be useful, novel, and nonobvious	Must have economic value
Subject Matter	Process, machine, manufacture, or composition of matter	No restriction
Protection	Protects against all infringers	Does not protect against independent discovery
Procedures	Registration Process and public disclosure	Reasonable efforts to keep secrecy
Duration	20 years from filing date	Unlimited

Patent and Trade Secret Protection

- Trade Secret
  - Later disclosure affects protection
  - Can be challenging to license
- Patent
  - Public disclosure may not result in any protection
  - Infringement detection can be challenging

Subject Matter
Does the AI/ML make a computer operate more efficiently or improve a product or process?

Rate of Innovation
Other researchers close to discovering the same AI/ML solution?
How long before the AI/ML solution is replaced?

Location and Actors
Does the Innovation span different jurisdictions and/or involve multiple actors?

Detectability
Is infringement of the Innovation detectable with or without a discovery process?

Areas for IP Protection

- Training Data
  - The raw data itself
  - Methods for obtaining or harvesting the training data
  - Methods for data augmentation, classification, or modification

- Model Training
  - How to improve training speed
  - How to improve the quality of the model
  - How to reduce the resources required for training
  - How to distribute the training process
  - The trained model itself

Areas for IP Protection Consideration

- Model Architecture
  - New Architecture
  - New Inputs
  - New Encoding
  - Customized Hardware

- Recommendations/Inferences
  - Integration into a larger system
  - Improved runtime performance (less resources or latency)
  - Optimized for hardware

Recent Caselaw and Trends

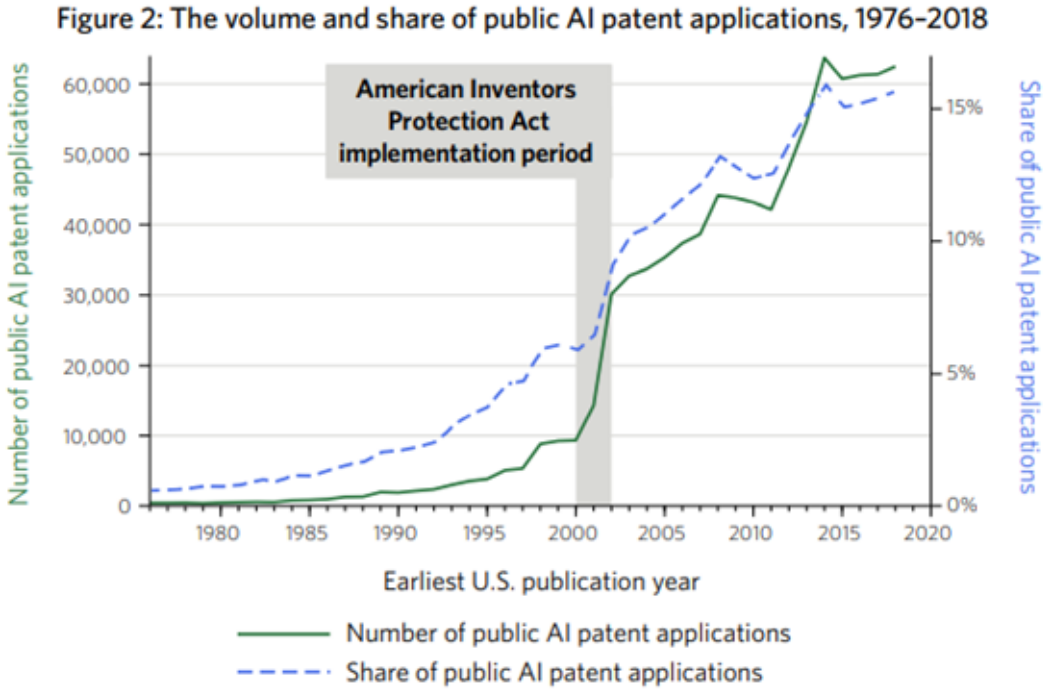
The law continues to evolve, and even the interpretations of current caselaw continues to evolve.

Recent Case Law affecting Patents that use AI

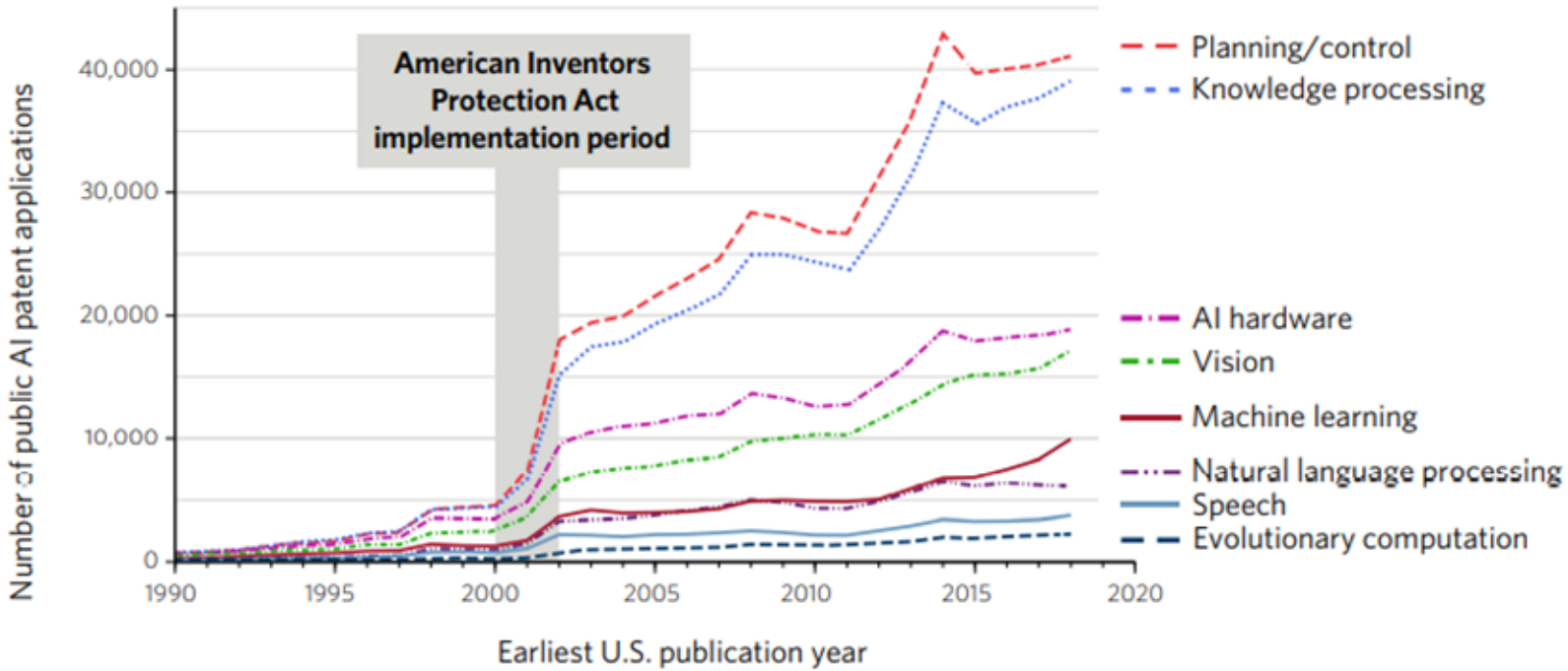
- Supreme Court
  - Alice
    - "first determine whether the claims [] are directed to a patent-ineligible concept" then determine whether the claim's elements transform the nature of the claim into a patent-eligible application.
- Federal Circuit
  - Electric Power Group
    - "[A] process of gathering and analyzing information of a specified content, then displaying the results" is an abstract idea.
  - Enfish
    - "Software can make non-abstract improvements to computer technology just as hardware improvements can."
  - McRO
    - Claim "a specific means or method that improves [a] technology" rather than "a result or effect that itself is the abstract idea."

Trends in Patents that use AI

- From 2002 to 2018, patent applications that use AI increased from 30,000/year to over 60,000/year.
- Patents utilizing AI appeared in more than 42% of all technology subclasses used by the USPTO in 2018.



Trends in Patents that use AI



Patent Strategy

In many cases, trade secret protection is not viable. What can you do to secure better patents?

US Patent Strategy

- Subject Matter
  - Provide details of a specific solution rather than general result
  - Describe a practical application
- Enablement
  - Provide architectural details in the specification (e.g., not just "modules" that achieve some objective)
- Non-obviousness
  - Claim the cause of the improvement

Subject Matter Eligibility – USPTO 2019 Guidance

- Example 39 – Method for Training a Neural Network for Facial Detection

Claim:

A computer-implemented method of training a neural network for facial detection comprising:

collecting a set of digital facial images from a database;

applying one or more transformations to each digital facial image including mirroring, rotating, smoothing, or contrast reduction to create a modified set of digital facial images;

creating a first training set comprising the collected set of digital facial images, the modified set of digital facial images, and a set of digital non-facial images;

training the neural network in a first stage using the first training set;

creating a second training set for a second stage of training comprising the first training set and digital non-facial images that are incorrectly detected as facial images after the first stage of training; and

training the neural network in a second stage using the second training set.

Subject Matter Eligibility – USPTO 2019 Guidance

– Example 39 Analysis

Step	Analysis
1: Statutory Category?	**Yes.** The claim recites a series of steps and, therefore, is a process.
2A - Prong 1: Judicial Exception Recited?	**No.** The claim does not recite any of the judicial exceptions enumerated in the 2019 PEG. For instance, the claim does not recite any mathematical relationships, formulas, or calculations. While some of the limitations may be based on mathematical concepts, the mathematical concepts are not recited in the claims. Further, the claim does not recite a mental process because the steps are not practically performed in the human mind. Finally, the claim does not recite any method of organizing human activity such as a fundamental economic concept or managing interactions between people. Thus, the claim is **eligible** because it does not recite a judicial exception.
2A - Prong 2: Integrated into a Practical Application?	**N/A.**
2B: Claim provides an Inventive Concept?	**N/A.**

Subject Matter Eligibility – Caveat

- One of the key problems with Subject Matter Eligibility in the United States is the high variation among patent examiners. There are many examiners who would classify the claim in Example 39 as an abstract idea. And even if you appeal to the Board, there are many Board panels that would affirm the Examiner.

European Patent Strategy

- The EPO implements Subject Matter Eligibility in a different way than the United States. Only features that are considered "technical" have any patentable weight. If a claim has features A, B, C, D, and E, an EPO examiner may deem features C and D to be "non-technical", and therefore ignore them. If the combination of features A, B, and E does not meet the requirements of novelty and inventive step, the claims will be rejected.

- From an EPO perspective, the area of Natural Language Processing is considered mostly non-technical, so inventions that use NLP are usually rejected.

European Patent Strategy

- AI/ML is considered a special category of computer implemented invention (CII).
- AI and ML models and algorithms are considered to be per se abstract mathematical methods.
  - Terms such as "support vector machine", "reasoning engine" or "neural network" do not necessarily imply the use of a technical means.
- Mathematical methods may contribute to the technical character of an invention (i.e., contribute to producing a technical effect that serves a technical purpose) by its application to a field of technology and/or by being adapted to a specific technical implementation.

EPO: Technical Effect Serving A Technical Purpose

- A claim must have a specific technical purpose.
- Each claim must be functionally limited to the technical purpose.
- EPO Examples:
  - The use of a neural network in a heart monitoring apparatus for the purpose of identifying irregular heartbeats
  - The classification of digital images, videos, audio or speech signals based on low-level features (e.g., edges or pixel attributes for images)
- The steps of generating the training set and training the classifier may contribute to the technical character of the invention if they support achieving that technical purpose.

EPO: Technical Implementations

- A claim can be directed to a specific technical implementation of a mathematical method
- The mathematical method is adapted for the implementation:
  - Motivated by technical considerations of the internal functioning of the system or network
  - Designed to exploit technical properties of the technical system to bring about a technical effect such as efficient use of computer storage capacity or network bandwidth
- EPO Examples:
  - The adaptation of a polynomial reduction algorithm to exploit word size shifts matched to the word size of the computer hardware
  - Assigning the execution of data-intensive training steps of a machine-learning algorithm to a graphical processing unit (GPU) and preparatory steps to a standard central processing unit (CPU) to take advantage of the parallel architecture

EPO: Comvik Approach to Inventive Step

- General Approach to Inventive Step
  - Determine the differences between the invention and the closest prior art
  - Determine the effect of the differences
    - Identify hypothetical problem-to-be-solved based on the closet prior art
  - Is the solution to the hypothetical problem-to-be-solved obvious?
- Comvik Approach for computer implemented inventions
  - Only the claim features that contribute to the solution of a technical problem are considered for inventive step
  - Any "non-technical" features are disregarded when determining differences with the closest prior art

General Patent Drafting Tips

- Claim drafting
  - Recite claim features that improve computer technology (e.g., reduction of resource usage, latency, or bandwidth)
  - Claim a specific means for improving a particular technology
  - Consider infringers (training may be performed by a separate entity than production)
- Written Description
  - Describe the problem and solution
  - Describe how the system uses AI to interact with the real world
  - Describe technological advantages and point out which features provide those advantages
  - Describe hardware implementations (e.g., tasks performed at FPGAs, GPUs, or CPUs)

What about Artificial Inventors?

To this point, the discussion has focused on how to protect inventions that use AI. But what happens when an AI system itself is the inventor?

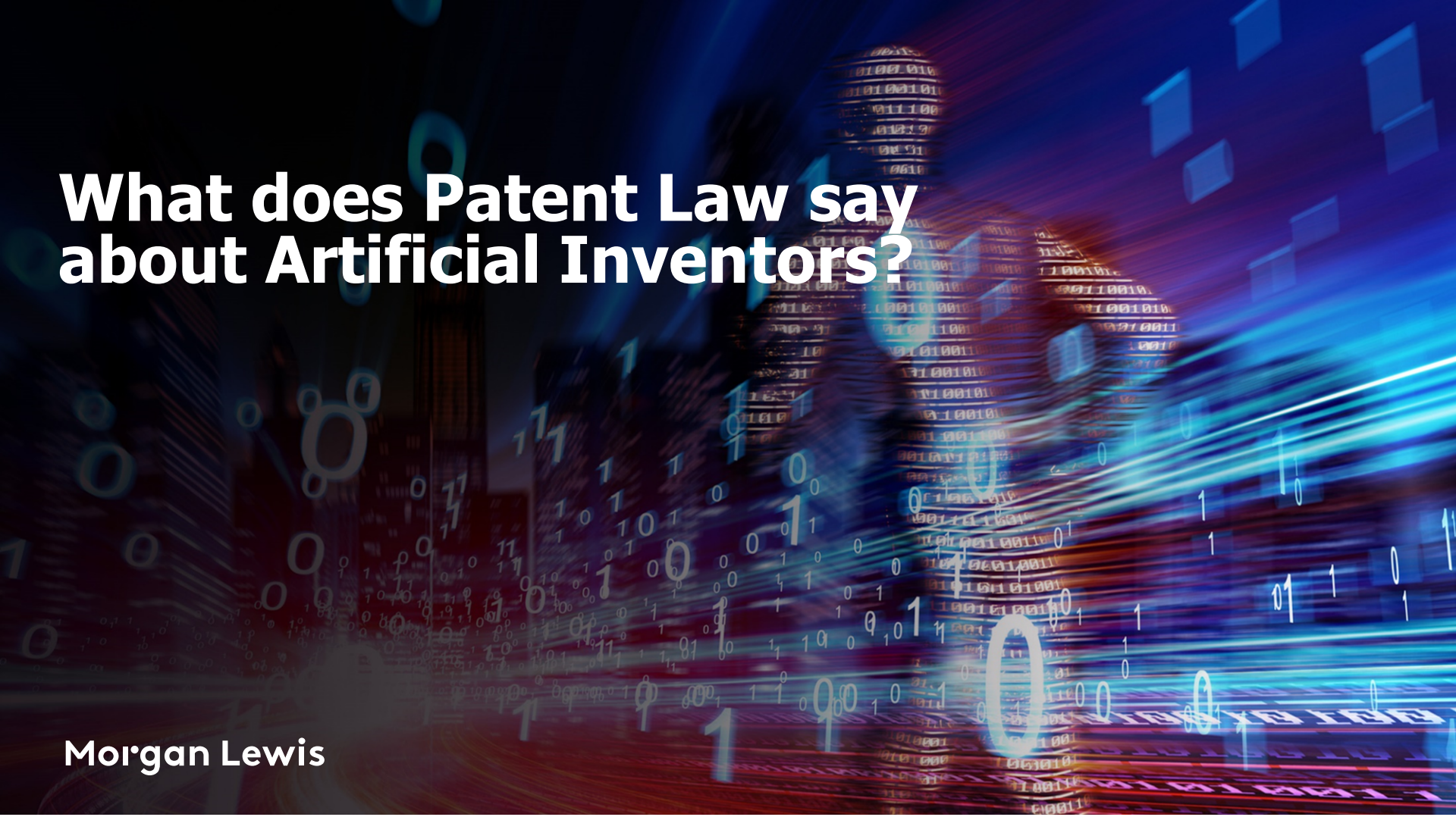
Artificial Inventors

- An AI Inventor (or "Artificial Inventor") is a complex system that autonomously creates a new process, device, system, or composition of matter.
- An Artificial Inventor is generally designed to handle a specific category of inventions, and usually has a set of input parameters that are user-specified.
- An Artificial Inventor generally works iteratively, with each iteration evolving from the previous iterations and testing the current version.

Artificial Inventors – Example

- I want an alloy material constructed from a specific set of elements, and I can specify various properties I want, such as tensile strength in a certain dimension, a maximum density, maximum cost, or torsional capacity around a certain axis. I may also specify shape characteristics.
- Today there already exist systems that can do this and provide the details of the material it invented. In addition to the specific component elements, the system specifies a lattice structure for how the elements are joined together, and a manufacturing plan.

What does Patent Law say about Artificial Inventors?



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Artificial Inventors in the United States

1. Inventors must be people:

   – 35 U.S.C. § 100: (f)The term "inventor" means the **individual** or, if a joint invention, the individuals collectively who invented or discovered the subject matter of the invention.

   – 35 U.S.C. § 101: **Whoever** invents or discovers any new and useful process, machine, manufacture, or composition of matter, or any new and useful improvement thereof, may obtain a patent therefor, subject to the conditions and requirements of this title.

Artificial Inventors in the United Kingdom

1. Inventors must be people:

- The England and Wales High Court held that "a patent can only be granted to a person." Based on Section 7 of the UK's Patents Act 1977, invention ownership rights vest upon first creation to the inventor, and then may be transferred. *See Thaler v. Comptroller*, September 21, 2020 at paragraph 38 ("the law differentiates between the first creation of a right and the subsequent transfer of that right," emphasis in the original). DABUS (the "Artificial Inventor") could not be a patent applicant because the Patents Act 1977 specially requires the applicant to be a person, and Dr. Thaler could not be the applicant because DABUS had no property rights that could be transferred.

Legal Issues with Artificial Inventors

- There are many examples that illustrate why Artificial Inventors is a non-trivial issue.

- I have suggested an adaption of patent laws in my earlier *Daily Journal* articles (September 30, 2019 and June 25, 2020). A human surrogate signs assignment and declaration documents on behalf of an AI inventor, helping clarify a chain of title of the invention from the initial creation to the applicant (the human surrogate may or may not be the applicant). Like current declarations in the United States, the human surrogate is subject to criminal penalties for perjury. (This also encourages the development of AI systems that are transparent and auditable.)


How does the law about
Artificial Inventors affect me?
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Hypothetical Litigation in 5 – 10 years

- A pharmaceutical company uses an AI system for new drug discovery. The AI system spends months to sort through hundreds of millions of possible drugs and identifies a dozen that meet the specified parameters. In accordance with all government regulations, the company follows the standard protocol for testing the 12 possible drugs (e.g., in vitro, then animals, then human). Assume that some of the dozen are discarded at various stages, and two are tested in humans. One of them is fantastic, and the company files for patents throughout the world.

Hypothetical Litigation in 5 – 10 years

- A few years after the patents issue, the company discovers a competitor has copied their fabulous new drug and sues for $500M.
- The defendant argues that the patents are invalid because the only actual "inventor" was the AI system, and AI inventors are not allowed.

Hypothetical Litigation in 5 – 10 years

- The defendant's arguments:
  - The actual invention was created by the months of work by the AI system.
  - The remainder of the testing was just standard work that ordinary technicians performed. None of the identified human inventors actually contributed to finding the drug.
  - Adhering to government regulations was not inventive.

Hypothetical Litigation in 5 – 10 years

- Some possible arguments for the plaintiff:
  - Human research scientists eliminated half of the potential drugs based on their microscopic analysis of the potential drugs.
  - Human research scientists had to develop a special line of mutant mice in order to test key aspects of how the drugs operated.
  - After selecting the best drug out of the 12 candidates, research scientists discovered a way to alter the structure slightly so that it was better in some way (e.g., more effective or better tolerated).

Protection of inventions created by Artificial Inventors

1. If patent protection is needed, make sure that the inventive process has at least one meaningful human inventor (like the plaintiff in the hypothetical). Using AI systems to invent is going to become increasingly necessary in order to be competitive, so implement development processes up front to include some people.

2. If an Artificial Inventor creates a tangible product, it is generally necessary to protect that product with a patent. However, if an AI system generates software, consider Trade Secret protection. This can be particularly effective if the software is running in the cloud, where it is much more difficult to reverse engineer.

Ukraine Conflict Resources

Our lawyers have long been trusted advisers to clients navigating the complex and quickly changing global framework
of international sanctions. Because companies must closely monitor evolving government guidance to understand what changes need to be made to their global operations to maintain business continuity, we offer a centralized portal to share our insights and analyses.

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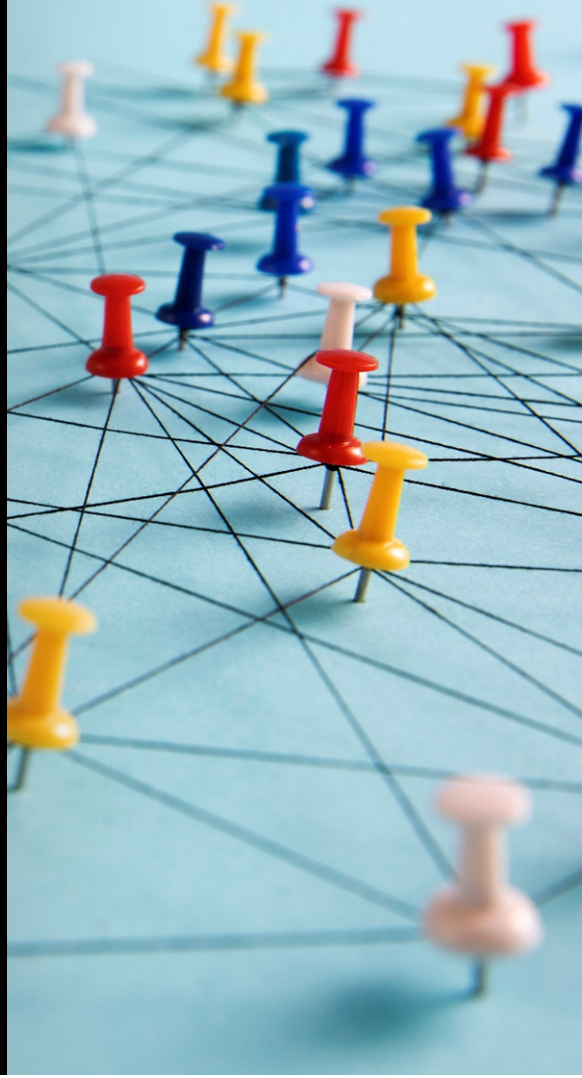

Biography

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Drawing on 12 years of experience in software development and database architecture, David V. Sanker, Ph.D., works with clients to build strong patent portfolios in a variety of areas, including artificial intelligence (AI), machine learning, natural language processing, data visualization software, large-scale database architecture and storage infrastructure, data analytics software, and touchscreen technology. As AI tools have become widely available, inventions that use AI have become an increasing portion of his work, including inventions in industrial automation and life sciences.

Biography

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Matthew M. Walker brings a diverse technical background and in-house perspective to his legal practice. This enables Matthew to bring depth and perspective to a practice that includes counseling clients on patent strategy, preparation, and prosecution across a variety of technical fields and jurisdictions. He routinely works with cutting-edge innovations in computer hardware and software, machine learning, semiconductors, superconductors, and biomedical devices.

Our Global Reach

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Europe
Latin America
Middle East
North America

Our Locations

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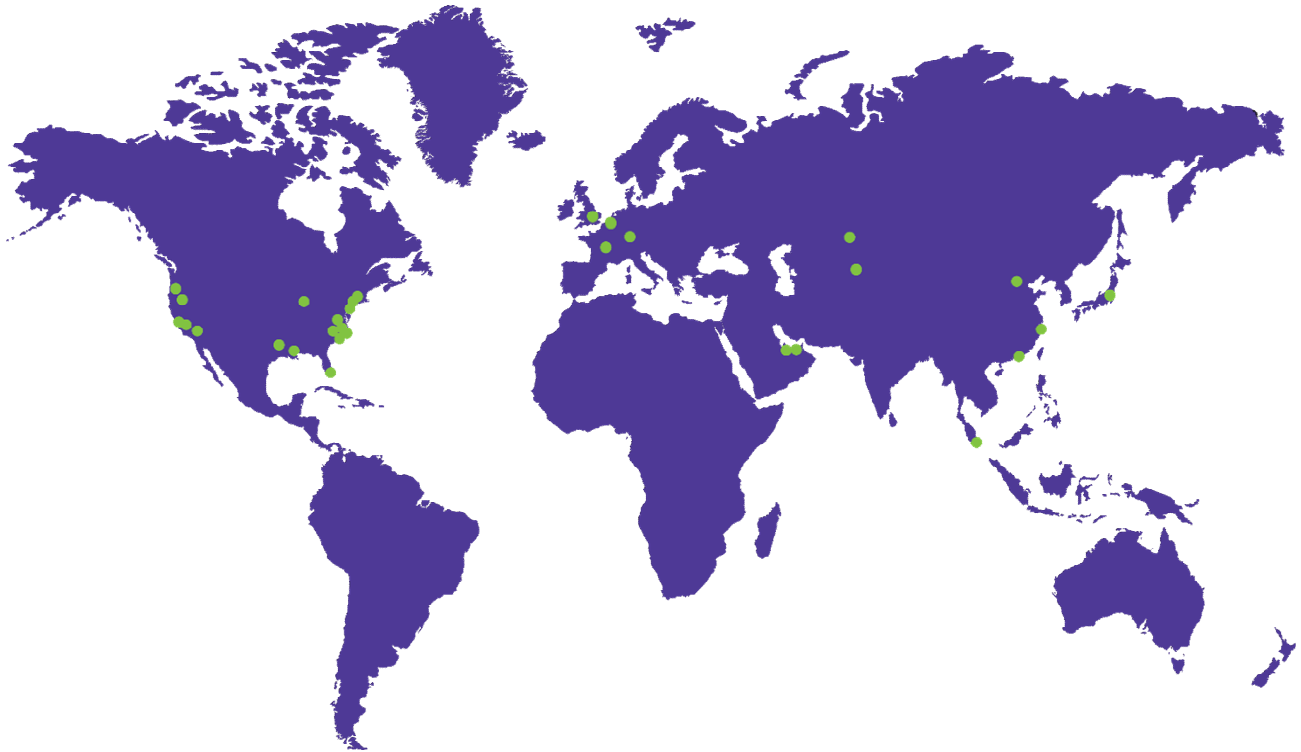

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